

Title: Cultural practices for producing dryland malt barley

Year: 2004

Locations: Western Triangle Ag. Research Center
Knees area east of Brady (Killon farm)
Ethrige area (Griffin farm)
Sunburst area (Aschim farm)
Joplin area (Moog farm)

Personnel:

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Objectives:

To determine the planting rate for optimum, dryland malt barley yield and quality; and to evaluate the effects of nitrogen (N) and sulfur (S) fertilization on yield and quality of malt barley.

Procedures:

Planting rates of 10, 15, and 20 seeds/ft², N rates of 0, 30, and 60 lbs N/acre, and S rates of 0, 10, and 20 lbs/acre were applied to Metcalfe barley at the following locations: WTARC, Knees, Joplin, Sunburst, and Ethrige. Nitrogen as urea and 25 lbs/acre of potassium (K) as KCl was applied broadcast while planting, and S as potassium thiosulfate or ammonium thiosulfate was dribbled on the soil surface about two inches from the seed row while planting also. All plots received 30 lbs P₂O₅/ acre as 0-45-0 applied with seed as well as KCl. Soils were sampled initially for water, nitrate-N, and sulfate-S in foot increments to a depth of three feet. Surface soil samples (0-6") were collected for standard soil analyses of pH, organic matter, phosphorus, etc. Results are shown in Table 1. Plots were harvested with a small plot combine, and the grain weighted and tested for protein and S content, (Note: due to Leco machine problems, protein and S content data are not available at this time for three locations) percent plump and thins, and test weight. Plot size was be 6 rows wide (12 inch spacing) and 25 feet long.

Results:

Summary: Site characteristics, grain yield, kernel plumpness, grain protein, and grain S content data are tabulated in Tables 1, 2, 3, 4, and 5. Grain yields ranged from 32 bu/ac on recrop to 97 bu/ac on fallow. All fallow locations had average yields greater than 70 bu/ac. Only one fallow location (Knees) had average plump less than 80 %, but this location had the highest residual soil N.

This years results indicate that the best chance for dryland malting barley growers producing acceptable quality malt barley on fallowed ground is by planting barley at 10 seeds/ft² with only starter fertilizers of P and K. Growers should select fields with the least amount of soil nitrate N, preferably with less than 60 lbs of nitrate N in three feet of soil, and plan on about 1.2 lbs of N/acre per bushel for acceptable protein and plump kernels. Sulfur fertilizers should not be used.

Planting rate: Increasing planting rate increased grain yields at only one location, WTARC. Kernel plumpness declined with increasing planting rate at the Knees and WTARC locations. Grain protein and S content were not affected by planting rate.

Nitrogen rate: Grain yields were increased and kernel plumpness declined with increasing N at all locations rate except Ethridge. Nitrogen fertilization increased protein and S content at all locations.

Sulfur rate: Grain yields at Joplin, Knees, and WTARC declined with increasing fertilizer S; yields were not affected at Ethridge and Sunburst. Kernel plumpness was not affected by S rate. Sulfur fertilization increased both protein and S content,

Table 1. Site characteristics and soil test results by location. Western Triangle Ag. Research Center. 2004.

Site Characteristics					
Character	Ethridge	Joplin	Knees	Sunburst	WTARC
Planting Date	April 14	May 3	April 27	April 26	April 13
Harvest Date	August 4	August 13	August 10	August 13	August 11
Previous Crop	Chemical Fallow	Chemical Fallow	Chemical Fallow	Barley	Conventional Fallow
Growing Season Precipitation (inches)	NA	5.44	4.75	5.15	5.9
Soil Test Results					
Test	Ethridge	Joplin	Knees	Sunburst	WTARC
pH	8.6	8.0	ND	6.3	8.5
O.M. (%)	2.1	1.3	ND	3.6	2.4
P (ppm)	26	19	ND	34	16
K (ppm)	578	366	ND	452	302
EC (mmhos/cm)	0.15	0.18	ND	0.13	0.23
NO ₃ -N (0-3', lb/ac)	47	57	80	39	63
SO ₄ -S (0-3', lb/ac)	212	2089	609	244	7110

ND=Not determined.

Table 2. Effect of nitrogen, sulfur, and planting rate on yield of dryland malt barley.
Western Triangle Ag. Research Center. 2004.

Treatment		Location				
Planting rate	N - S	Ethridge	Joplin	Knees	Sunburst	WTARC
Seeds/ft ²	lbs/ac	-----bu/acre-----				
10	0 - 0	77.2	76.9	78.2	34.3	91.3
15	0 - 0	79.4	78.3	73.4	32.8	96.7
20	0 - 0	73.3	75.9	76.2	33.2	96.6
10	30 - 0	79.3	82.6	72.3	34.0	99.2
15	30 - 0	80.3	79.8	78.9	33.0	100.3
20	30 - 0	79.3	85.5	77.1	35.6	101.8
10	60 - 0	79.6	85.5	72.5	27.8	102.4
15	60 - 0	78.8	83.9	76.1	28.6	106.1
20	60 - 0	81.7	89.4	71.8	29.5	103.3
10	0 - 10	79.8	73.8	69.5	33.0	90.1
15	0 - 10	81.0	72.8	69.3	32.9	92.3
20	0 - 10	83.1	76.0	71.5	39.9	92.2
10	30 - 10	79.6	80.2	66.2	29.0	91.2
15	30 - 10	81.0	84.4	70.0	34.0	92.4
20	30 - 10	76.6	75.4	71.6	32.2	96.7
10	60 - 10	80.3	79.3	68.1	28.6	94.7
15	60 - 10	80.8	71.1	70.5	28.2	99.9
20	60 - 10	72.7	81.6	65.0	31.4	107.0
10	0 - 20	79.3	73.3	70.5	30.3	91.0
15	0 - 20	72.1	71.4	70.3	35.7	93.7
20	0 - 20	74.8	69.5	70.8	32.7	93.0
10	30 - 20	75.4	80.2	75.0	31.6	94.2
15	30 - 20	74.3	77.6	70.0	31.9	99.4
20	30 - 20	76.2	77.3	68.4	32.3	97.8
10	60 - 20	74.0	81.5	67.4	32.7	96.1
15	60 - 20	79.6	85.6	65.3	26.7	95.8
20	60 - 20	81.6	85.8	66.9	28.8	98.8
Planting Rate Summary						
10		78.3 a	79.2 a	71.1 a	31.2 a	94.5 a
15		78.6 a	78.3 a	71.5 a	31.5 a	97.4 b
20		77.7 a	79.6 a	71.0 a	32.8 a	98.6 b
P-value, Linear contrast		0.688	0.705	0.974	0.199	0.003
P-value, Quad. contrast		0.642	0.405	0.688	0.638	0.452
Nitrogen Summary						
0		77.8 a	74.2 a	72.2 a	33.9 a	93.0 a
30		78.0 a	80.3 b	72.2 a	32.6 b	97.0 b
60		78.8 a	82.6 b	69.3 b	29.1 b	100.0 c
P-value, Linear contrast		0.493	0.001	0.046	0.001	0.001
P-value, Quad. contrast		0.816	0.184	0.244	0.308	0.791

Table 2. Continued.					
Sulfur Summary					
Treatment	Location				
lbs S/ ac	Ethridge	Joplin	Knees	Sunburst	WTARC
0	78.3 a	82.0 a	75.1 a	32.1 a	99.8 a
10	78.6 a	77.2 b	69.1 b	32.1 a	95.2 b
20	77.7 a	78.0 b	69.4 b	31.4 a	95.5 b
P-value, Linear contrast	0.097	0.027	0.001	0.602	0.002
P-value, Quad. contrast	0.142	0.123	0.011	0.728	0.037
Statistical Summary					
Mean	78.2	79.0	71.2	31.9	96.8
CV (%)	7.8	9.6	8.5	16.4	5.9
Interaction	Interaction p-values				
Plt Rate x N Rate	0.932	0.619	0.680	0.789	0.936
Plt Rate x S Rate	0.607	0.946	0.677	0.621	0.649
N Rate x S Rate	0.252	0.245	0.925	0.606	0.219
N Rate x S Rate x Plt rate	0.223	0.601	0.569	0.541	0.730

Yield means with the same letter are not significantly different accord to the LSD (p=0.05).

Table 3. Effect of nitrogen, sulfur, and planting rate on kernel plumpness of dryland malt barley. Western Triangle Ag. Research Center. 2004.

Treatment		Location				
Planting rate	N - S	Ethridge	Joplin	Knees	Sunburst	WTARC
Seeds/ft ²	lbs/ac	-----%-----				
10	0 - 0	83.8	76.9	84.0	45.0	95.3
15	0 - 0	90.8	48.3	69.5	42.3	93.5
20	0 - 0	87.5	75.9	68.5	42.5	89.0
10	30 - 0	75.3	82.6	68.8	13.3	92.3
15	30 - 0	78.8	79.8	61.8	12.5	83.8
20	30 - 0	86.5	85.5	55.0	14.3	82.3
10	60 - 0	79.3	85.5	49.8	3.3	89.5
15	60 - 0	84.3	83.9	46.5	4.3	78.3
20	60 - 0	80.5	89.4	36.0	1.5	86.5
10	0 - 10	73.8	73.8	80.8	36.0	92.8
15	0 - 10	75.3	72.8	72.0	28.9	93.5
20	0 - 10	80.8	76.0	67.5	21.0	87.3
10	30 - 10	83.3	80.2	67.5	22.5	90.0
15	30 - 10	92.3	84.4	61.5	21.3	87.0
20	30 - 10	87.0	75.4	57.8	15.6	79.0
10	60 - 10	84.3	79.3	64.0	6.8	86.0
15	60 - 10	87.8	71.1	47.3	6.3	80.8
20	60 - 10	84.3	81.6	31.0	13.5	81.8
10	0 - 20	64.0	73.3	77.3	31.3	96.3
15	0 - 20	90.8	71.4	73.0	42.0	89.8
20	0 - 20	83.4	69.5	69.0	25.5	93.8
10	30 - 20	93.8	80.2	74.3	23.3	91.5
15	30 - 20	83.8	77.6	63.8	17.5	89.3
20	30 - 20	85.3	77.3	54.3	16.3	87.0
10	60 - 20	89.5	81.5	59.0	12.3	87.8
15	60 - 20	90.0	85.6	56.8	14.8	87.8
20	60 - 20	76.5	85.8	41.5	5.5	77.3
Planting Rate Summary						
10		80.8 a	90.0 a	69.5 a	21.5 a	91.3 a
15		85.9 a	87.4 a	61.3 b	21.1 a	87.1 b
20		83.4 a	86.7 a	53.4 c	17.3 a	84.9 b
P-value, Linear contrast		0.288	0.169	0.001	0.168	0.001
P-value, Quad. contrast		0.099	0.624	0.968	0.529	0.477
Nitrogen Summary						
0		81.1 a	93.9 a	73.5 a	34.9 a	92.3 a
30		85.1 a	89.7 a	62.7 b	17.4 b	86.9 b
60		84.0 a	80.5 b	48.0 c	7.6 c	83.9 b
P-value, Linear contrast		0.274	0.001	0.001	0.001	0.001
P-value, Quad. contrast		0.274	0.181	0.409	0.145	0.375

Table 3. Continued.					
Sulfur Summary					
Treatment	Location				
lbs S/ac	Ethridge	Joplin	Knees	Sunburst	WTARC
0	82.9 a	88.4 a	60.0 a	19.9 a	87.8 a
10	83.2 a	87.4 a	61.0 a	19.1 a	86.4 a
20	84.1 a	88.2 a	63.2 a	20.9 a	88.9 a
P-value, Linear contrast	0.650	0.928	0.247	0.727	0.494
P-value, Quad. contrast	0.869	0.481	0.817	0.819	0.175
Statistical Summary					
Mean	83.4	87.8	61.4	20.0	87.7
CV (%)	13.3	10.2	19.1	64.1	7.8
Interaction	Interaction p-values				
Plt Rate x N Rate	0.176	0.876	0.539	0.832	0.817
Plt Rate x S Rate	0.841	0.644	0.934	0.771	0.667
N Rate x S Rate	0.044	0.051	0.746	0.022	0.918
N Rate x S Rate x Plt rate	0.168	0.245	0.826	0.848	0.272

Yield means with the same letter are not significantly different accord to the LSD (p=0.05).

Table 4. Effect of nitrogen, sulfur, and planting rate on grain protein content of dryland malt barley. Western Triangle Ag. Research Center. 2004.

Treatment		Location				
Planting rate	N - S	Ethridge	Joplin	Knees	Sunburst	WTARC
Seeds/ft ²	lbs/ac	-----%-----				
10	0 - 0			13.2	11.3	
15	0 - 0			14.4	11.3	
20	0 - 0			13.6	11.7	
10	30 - 0			13.8	13.5	
15	30 - 0			13.5	13.3	
20	30 - 0			13.4	13.9	
10	60 - 0			15.0	16.2	
15	60 - 0			15.4	15.2	
20	60 - 0			15.1	14.9	
10	0 - 10			14.1	12.6	
15	0 - 10			13.4	12.9	
20	0 - 10			14.4	15.3	
10	30 - 10			15.5	13.7	
15	30 - 10			15.0	14.3	
20	30 - 10			13.9	14.0	
10	60 - 10			16.5	14.6	
15	60 - 10			16.2	15.8	
20	60 - 10			15.4	14.8	
10	0 - 20			14.2	13.0	
15	0 - 20			13.9	13.4	
20	0 - 20			14.6	15.0	
10	30 - 20			14.3	13.8	
15	30 - 20			14.4	13.8	
20	30 - 20			15.2	15.2	
10	60 - 20			15.0	15.1	
15	60 - 20			15.4	15.4	
20	60 - 20			15.1	15.1	
Planting Rate Summary						
10				14.7 a	13.8 a	
15				14.6 a	13.9 a	
20				14.5 a	14.4 a	
P-value, Linear contrast				0.514	0.119	
P-value, Quad. contrast				0.891	0.675	
Nitrogen Summary						
0				14.0 a	12.9 a	
30				14.3 a	13.9 b	
60				15.5 b	15.2 c	
P-value, Linear contrast				0.001	0.001	
P-value, Quad. contrast				0.099	0.674	

Table 4. Continued.					
Sulfur Summary					
	Location				
	Ethridge	Joplin	Knees	Sunburst	WTARC
0			14.2 a	13.5 a	
10			14.9 b	14.2 ab	
20			14.8 b	14.4 b	
P-value, Linear contrast			0.048	0.031	
P-value, Quad. contrast			0.062	0.447	
Statistical Summary					
Mean			14.6	14.0	
CV (%)			8.5	12.5	
Interaction	Interaction p-values				
Plt Rate x N Rate			0.670	0.266	
Plt Rate x S Rate			0.489	0.664	
N Rate x S Rate			0.509	0.078	
N Rate x S Rate x Plt rate			0.697	0.965	

Yield means with the same letter are not significantly different accord to the LSD (p=0.05).

Table 5. Effect of nitrogen, sulfur, and planting rate on grain sulfur content of dryland malt barley. Western Triangle Ag. Research Center. 2004.

Treatment		Location				
Planting rate	N - S	Ethridge	Joplin	Knees	Sunburst	WTARC
Seeds/ft ²	lbs/ac	-----%-----				
10	0 - 0			0.160	0.153	
15	0 - 0			0.174	0.152	
20	0 - 0			0.167	0.158	
10	30 - 0			0.169	0.174	
15	30 - 0			0.166	0.170	
20	30 - 0			0.166	0.172	
10	60 - 0			0.178	0.192	
15	60 - 0			0.183	0.188	
20	60 - 0			0.181	0.181	
10	0 - 10			0.171	0.167	
15	0 - 10			0.165	0.167	
20	0 - 10			0.174	0.187	
10	30 - 10			0.185	0.174	
15	30 - 10			0.186	0.176	
20	30 - 10			0.172	0.176	
10	60 - 10			0.188	0.179	
15	60 - 10			0.194	0.190	
20	60 - 10			0.189	0.185	
10	0 - 20			0.170	0.166	
15	0 - 20			0.212	0.174	
20	0 - 20			0.180	0.184	
10	30 - 20			0.173	0.173	
15	30 - 20			0.181	0.175	
20	30 - 20			0.182	0.184	
10	60 - 20			0.189	0.185	
15	60 - 20			0.185	0.187	
20	60 - 20			0.186	0.182	
Planting Rate Summary						
10				0.176 a	0.174 a	
15				0.183 a	0.175 a	
20				0.177 a	0.179 a	
P-value, Linear contrast				0.765	0.160	
P-value, Quad. contrast				0.117	0.758	
Nitrogen Summary						
0				0.175 a	0.168 a	
30				0.175 a	0.175 b	
60				0.186 b	0.185 c	
P-value, Linear contrast				0.017	0.001	
P-value, Quad. contrast				0.227	0.562	

Table 5. Continued.					
Sulfur Summary					
Treatment	Location				
lbs S/ac	Ethridge	Joplin	Knees	Sunburst	WTARC
0			0.171 a	0.171 a	
10			0.180 ab	0.178 ab	
20			0.184 b	0.179 b	
P-value, Linear contrast			0.007	0.030	
P-value, Quad. contrast			0.514	0.320	
Statistical Summary					
Mean			0.179	0.176	
CV (%)			11.0	8.5	
Interaction	Interaction p-values				
Plt Rate x N Rate			0.676	0.250	
Plt Rate x S Rate			0.748	0.622	
N Rate x S Rate			0.340	0.063	
N Rate x S Rate x Plt rate			0.539	0.991	

Yield means with the same letter are not significantly different accord to the LSD (p=0.05).